Implementation of advice for data-limited stocks: A survey approach for Greenland halibut in SA 0+1

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Implementation of advice for data-limited stocks: A survey approach for Greenland halibut in SA 0+1

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Introduction

The assessment of Greenland halibut in Subarea 0 and 1A (offshore)+1B-F relies on several fishery independent survey indices. Multi-species trawl surveys of Divisions 1CD and 0A-south provide indices for that portion of the population impacted by trawl fishing fleets and the West Greenland shrimp trawl survey provides an index of recruitment (ages 1-3 yrs). Fishery dependent indices of CPUE for both trawl and gillnet fleets and length frequency samples from most fleets are also available. A reliable age determination method is not available. The development of a production type model for this stock has been attempted several times over the last 10 years or so without success. Catch advice has been qualitative, based on expert opinion following examination of the trends in the above indices and taking into consideration life-history characteristics for Greenland halibut in the Northwest Atlantic. Industry and fishery managers are calling for us to move forward with implementing a Precautionary Approach and to develop Harvest Control Rules that will help them achieve Marine Stewardship Council or other eco-label designations. In 2014 a proxy for Blim based on guidance from NAFO SC (NAFO 2012) was established as 30% of the mean survey biomass for years 1997 to 2012. The application of the ICES guidance on data limited stocks (DLS) (ICES 2012a and 2012b) as the basis for our approach for advice on SA0+1 Greenland Halibut could also be helpful in achieving this objective.

Summary of ICES WKFRAME III Report (ICES CM 2012/ACOM:39)

ICES has develop an empirical approach to providing advice in the case of data limited stocks that include methods that use the trend in the stock response to fishing pressure (ICES 2012a). The empirical basis was given a generic expression $C_{y+1}=Catch_{recent}*r*b*f*\Theta$, where:

$Catch_{recent}$ is the average catch over some period,
r is the trend in development of the stock (normally SSB),
b an evaluation of whether the stock is at risk of productivity impairment given by $\min[1,b_{current}/MSYB_{triggerproxy}]$,
f is the ratio of $F_{msyproxy}/F_{current,}$ and
Θ is an expression of the uncertainty of the information (also referred to as a precautionary factor) where Θ=1when b, r and f are computed, otherwise Θ=0.9 (where 0.9 is an arbitrary number requiring input from managers).

The generic expression was presented in tabular form in the WKFRAME III report (ICES 2012a). The tables categorized different conditions of productivity status based on stock size relative to a biomass trigger, trend in stock development and exploitation status. Two tables were provided, one for situations where it was possible to produce numerical estimation of b, or r, or f and a second one for situations where more than one of these parameters is unknown or not enumerated.

The use of the precautionary factor (θ) allowed for the inclusion of the Precautionary Approach (PA) in a quantitative way in the advice framework for data limited stocks. In the model formulations in the tables θ is represented by pb and/or pr and/or pf to link it directly to the stock pressure or state indices in the formulation. It is recognized that θ represents an element of risk evaluation, and whilst an arbitrary figure of 0.9 was proposed by ICES (2012a) this value would be established by fishery managers.

To avoid large changes in catch that may not reflect population changes WKFRAME III advised establishing an interval within which r is restricted, and the example of 0.5 to 1.5 is given. So the maximum change permitted does not exceed 50%. The report also discussed the application of a cap on the % change in the overall TAC advice from one assessment to the next and suggested a 20% level while noting that this risk level would be established by fishery managers.

The ICES WKFRAME III notes that because of the delay between action (change in catch) and response (state of the stock (b), trend in stock development (r), and pressure from the fishery (f)), the advice from the tables should not be assumed to be applicable as annual advice.

Summary of ICES DLS Guidance Report 2012 (ICES CM/ACOM:68)

The ICES Secretariat worked with ACOM and the Expert Groups to review the guidelines set out by WKFRAME III, RGLIFE, and WKLIFE to further develop an approach for data-limited stocks. Data-limited stocks were categorized into a hierarchy based on the type of data available and in the context of the precautionary approach, methodologies were identified that could provide quantitative advice for the stocks given the information available (ICES 2012b). Some of the methods have been tested by simulation, some require further testing and some are based on common sense. There were 131 stocks over 11 Expert Working Groups in which the Data Limited Stock (DLS) Methods Guidance was applied in 2012.

The DLS Guidance (2012b) is modified from the WKFRAME III report (ICES 2012a) although there are still elements of the earlier report in the DLS Guidance, for example: 1) the uncertainty cap (or change cap) of 20% has been included; and 2) parameters such as pr, pb and pf have been replaced by a "precautionary buffer" that is applied for those cases when the stock status relative to candidate reference points for stock size or exploitation is unknown or in circumstances where the survey index is below the survey-based proxy for MSYBtrigger. Typically this would be a one-time application although subsequent uses of the precautionary buffer are not ruled out if the stock continues to remain below the trigger or limit reference point. The Guidance notes that there is room for exceptions to the precautionary buffer rule in cases where expert judgement determines that the stock is not reproductively impaired, and where there is evidence that the stock is increasing or that exploitation has reduced significantly.

In WKFRAME III it is mentioned that managers would determine the level of risk they prefer but in the absence of guidance from managers ICES recommended a precautionary factor of 10% for each of pb and pf (ICES 2012a). The concept of the 20% precautionary buffer in the DLS Guidance (ICES 2012b) may have been derived from the precautionary factors in the WKFRAME III approach. So the level of the precautionary buffer would likely be determined by managers although this is not explicitly mentioned in the DLS Guidance.

The placement of bounds on the change in r described in WKFRAME III was not mentioned in the DLS Guidance (ICES 2012b) and may not be necessary to include if the change cap is applied.

The recommendation for multi-annual advice in the case of data-limited stocks is re-iterated in the DLS Guidance Report.

Application of the ICES Framework for data poor stocks for Greenland Halibut in Subarea 0 and 1

In the case of Greenland halibut in Subarea 0 and 1 we are not able to estimate SSB (due to survey trawl selectivity) or $F_{msyproxy}$. However, we have stock abundance indexes based on surveys that are used to assess the status of two portions of the stock area, 0A1AB (0A-south survey) and 0B1C-F (1CD survey). The ICES Benchmark Workshop (ICES 2013) recommended combining these two indices to create a single index with which to monitor the overall stock status, while still tracking individual survey trends. So we have a biomass index and Blim has been defined but Bbuf or a survey based equivalent to the ICES MSY Btrigger (e.g. lowest observed survey index or 25th percentile of survey indices) have not been defined and there is no proxy for F.

A proxy for F (catch/ biomass) might be considered for Div. 1CD where almost all the catches are taken with trawl, however, 50 % of the catches in Div. 0A and 30% of catches in Div. 0B are taken by gillnets that fish on a fraction of the population (larger fish) that is not coved by the trawl survey, so an index based only on 1CD catch/biomass would not be appropriate.

Given the data available this stock is considered a Category 3 stock for which survey-based assessments indicate trends. Method 3.2 (i.e. $C_{y+1}=Catch_{recent}*r$ from the WKFRAME III report) that includes application of the change cap and precautionary buffer to the catch advice would be most appropriate.

The calculation of r should in principle represent the spawning stock biomass (SSB index). However, if such an index is not available any other measure which is a proxy for the SSB could be used although they note that an abundance index which is dominated by recruitment would not have desirable properties in this respect. The trawl surveys used to determine biomass and abundance of Greenland Halibut tend to be dominated by immature fish so they may not be ideal for use in estimating stock response but they are currently the only source of fishery independent data to determine stock status. So it is proposed that total survey biomass be used as a proxy for SSB and to estimate r. Standardized catch per km^2 could also be used but the trends are the same.

The number of years used in the calculation of r should be large enough to account for inter-annual variability in the surveys and to reflect the consequences of management actions (e.g. an increasing stock trend after some years of low fishing mortality). The decision should also consider the species longevity and productivity with more years included for longer lived, less productive species. There is some year to year variability in the survey index and Greenland halibut are relatively long lived (max age of 30+ years) so a value greater than 5 might be considered for use in the calculation of r and so we give examples for both n=5 and n=7 years below.

The term $Catch_{recent}$ could be simply C_{y-1} or it could be the mean of several recent years. For Greenland halibut in SA0+1 catches have increased recently (Fig. 1) so an average of the last 3 years has been chosen for the $Catch_{recent}$ value.

There are seven surveys available from Div. 0A-south and Div. 1CD combined that cover a 15 year period, 1999, 2001, 2004, 2008, 2010, 2012 and 2014 (the 2006 survey has been dropped due to very poor coverage) (Fig. 2).

Application of Method 3.2 - $C_{y+1}=Catch_{recent}*r$

7 Surveys

Catch in 2016=28 819 t* (index mean value for 2014 and 2012/ index mean value for 2010, 2008, 2004)

=28 819 t * 1.041

=30 000 t.

5 Surveys

Catch in 2016 =28 819 t* (index mean value for 2014, 2012 and 2010/ index mean value for 2008, 2004, 2001, 1999)

=28 819 t *1.036

=29 856 t.

The DLS Guidance indicates the precautionary buffer should be applied, for example we do not have an estimate of F or a proxy for F. However, there is an accepted Blim and the biomass index is well above this limit. Also, recruitment has been well above the 1997 to 2012 average (142 805 t) in two of the last 5 years. We suggest that the precautionary buffer would not be required at this time. If circumstances were to change and the biomass fell significantly then we would need to re-assess.

The TAC change is less than 20% so the change cap would not be applied.

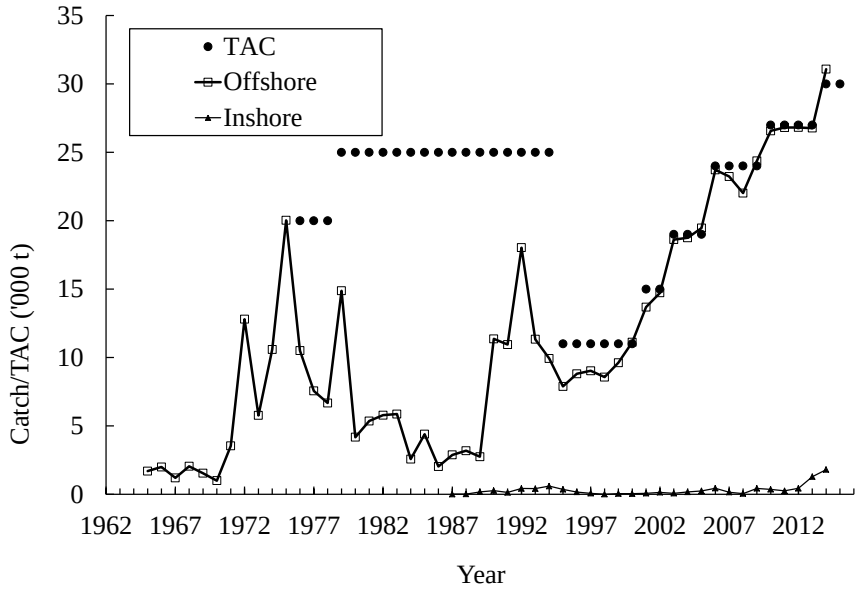

Fig. 1. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): catches and TACs.

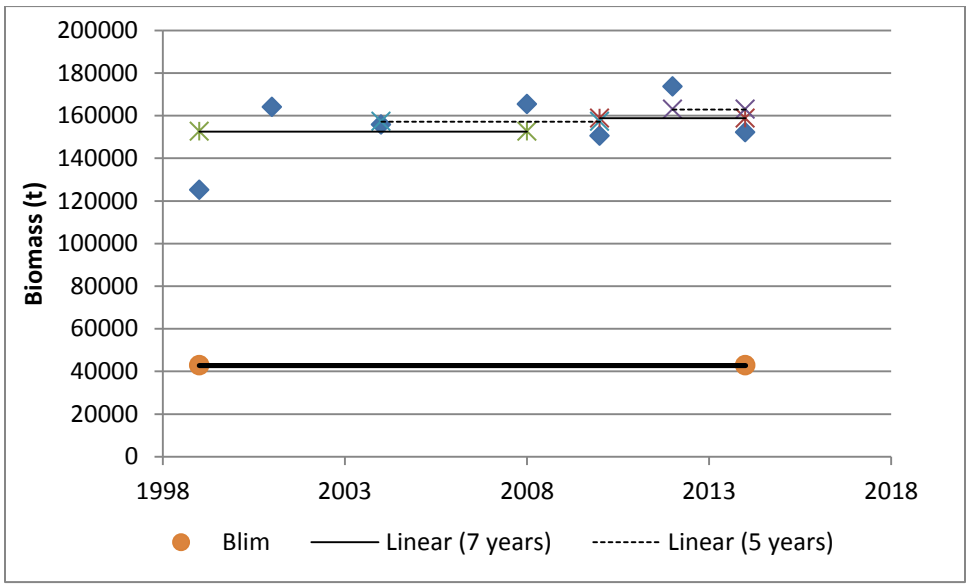

Fig. 2. Biomass index for Div. 0A-South and 1CD with Blim, average biomass in the most recent three surveys and the preceding four surveys (7 year time frame-solid lines) and the most recent two surveys and the preceding three surveys (5 year time frame-dashed line).

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